

**REMARKS**

Reconsideration and allowance of this application, as amended, are respectfully requested. Claims 4, 6, and 7 have been canceled; the written description and claims 1-3, 5, and 8-14 have been amended. Claims 1-3, 5, and 8-15 are now pending in the application. The rejections are respectfully submitted to be obviated in view of the amendments and remarks presented herein.

The written description has been editorially amended in response to the objection to the informalities. The written description has also been editorially amended to clarify the nature of the disclosed "flux barrier" (and thereby eliminate any possible source of confusion between the flux barrier and the hole). Support for the amendments to the written description is found in the Detailed Description of the Invention. As used by Applicants, flux barrier means the hole which has substantially the same figure (shape or form) as the permanent magnet, and the hole is one in which the permanent magnet is not inserted. Reconsideration and withdrawal of the objection are respectfully requested. In view of the aforementioned clarification (and the amendment of claim 8), the objection to the drawings is similarly deemed to be overcome.

The claims have been editorially amended both in response to the rejection under Section 112, first paragraph, and for improved readability. The rejection with respect to claim 13, however, is respectfully traversed. The meaning of the recited "180-degree current-applied sinusoidal wave inverter" would be evident to one skilled in the art from, for example, Applicants' Fig. 15 and the associated description at specification page

22, lines 9-20. Reconsideration and withdrawal of the rejection under Section 112 are respectfully requested.

35 U.S.C. § 103(a) – Takezawa in view of Kenji

Claims 1-7 stand rejected under 35 U.S.C. § 103(a) as allegedly being unpatentable over Takezawa in view of Kenji.

The rejection is respectfully traversed. The claimed invention would not have been obvious because there is no suggestion or motivation, either in the references or in the knowledge generally available to one of ordinary skill in the art, to combine the reference teachings to attain the claimed invention.

The asserted combination fails to suggest the machine defined in claim 1, for example, which includes a stator provided with concentrated winding armature wiring in multiple teeth on a stator core, a first rotor core split into multiple parts in an axial direction and containing permanent magnets built in multiple permanent magnet insertion holes having substantially V-shapes, and the first rotor core arranged so that a gap length of a magnetic path on q-axis side is greater than that on d-axis side.

For at least the above reasons, reconsideration and withdrawal of the rejection of claims 1-7 under § 103(a) are respectfully requested.

35 U.S.C. § 103(a) – Takezawa in view of Kenji and further in view of Narita

Claims 8-11 stand rejected under 35 U.S.C. § 103(a) as allegedly being unpatentable over Takezawa in view of Kenji and further in view of Narita.

The rejection is respectfully traversed. The claimed invention would not have been obvious because there is no suggestion or motivation, either in the references or in the knowledge generally available to one of ordinary skill in the art, to combine the reference teachings to attain the claimed invention.

Takezawa relates to the rotor of the electric motor in which the concave portion is provided in the q-axis side of the magnet rotor. Narita relates to a permanent magnet rotor type electric motor in which the rotor is divided in two. Further, Narita discloses that the electric motor of the combination of the rotor in which the magnet is inserted with the rotor in which the magnet is not inserted. Takezawa and Narita disclose the distributed winding stator. Takezawa discloses the magnets between the adjacent poles being arranged in parallel. Narita discloses the rotor being inserted in the magnet having the concave portion not being formed in q-axis side.

As indicated above in response to the rejection over Takezawa in view of Kenji, however, the asserted combination fails to suggest the machine defined in claim 1, for example, which includes a stator provided with concentrated winding armature wiring in multiple teeth on a stator core, a first rotor core split into multiple parts in an axial direction and containing permanent magnets built in multiple permanent magnet insertion holes having substantially V-shapes, and the first rotor core arranged so that a gap length of a magnetic path on q-axis side is greater than that on d-axis side. The disclosure of Narita adds nothing to rectify the deficiency associated with Takezawa and Kenji.

Furthermore, with regard to claim 8, Takezawa, Kenji, and Narita do not suggest the claimed arrangement of the permanent magnet insertion hole provided on the first rotor core being different from that of a flux barrier provided on the second rotor core.

For at least the above reasons, reconsideration and withdrawal of the rejection of claims 8-11 under § 103(a) are respectfully requested.

35 U.S.C. § 103(a) – Takezawa in view of Kenji and Narita and further in view of Fukuda

Claim 12 stands rejected under 35 U.S.C. § 103(a) as allegedly being unpatentable over Takezawa in view of Kenji and Narita and further in view of Fukuda.

For at least all of the reasons indicated above in response to the rejection over Takezawa and Kenji in view of Narita, the rejection is respectfully traversed.

Fukuda relates to a permanent magnet electric motor comprising the second core to which the permanent magnet is inserted and the first core to which the flux barrier is formed. In Fukuda, by cutting of the part of the first core, the balance weight of the rotor is adjusted.

In Applicants' claim 12, the non-magnetic substances are inserted into the flux barrier and then the positioning of the permanent magnet is carried out.

The construction of the first core and the second core shown in Fukuda differs from the construction of the first core and the second core shown in the Applicants'

claimed invention. Fukuda fails to suggest the feature of the present invention defined in claim 12 in which the non-magnetic substances are inserted into the flux barrier.

For at least the above reasons, reconsideration and withdrawal of the rejection of claim 12 under § 103(a) are respectfully requested.

35 U.S.C. § 103(a) – Takezawa in view of Kenji, Narita, and Fukuda and further in view of Moreira

Claims 13-15 stand rejected under 35 U.S.C. § 103(a) as allegedly being unpatentable over Takezawa in view of Kenji, Narita, and Fukuda and further in view of Moreira.

For at least all of the reasons indicated above, the rejection is respectfully traversed.

Moreira relates to the motor control for a brushless permanent magnet using only three wires in which in a 120-degree electric application, using the third high harmonic wave the magnet pole position of the rotor is detected.

On the other hand, according to the present invention, using the protruded pole characteristics of the reactance the magnetic pole position is detected and the permanent magnet rotating electrical machine is driven by a 180-degree current-applied inverter.

The brushless permanent magnet motor shown by Moreira differs from the permanent magnet rotating electrical machine claimed by Applicants. Moreira fails to suggest the feature of the present invention defined in claim 13, in which the permanent

magnet rotating electrical machine is driven by 180-degree current-applied sinusoidal wave inverter.

For at least the above reasons, reconsideration and withdrawal of the rejection of claims 13-15 under § 103(a) are respectfully requested.

Attached hereto is a marked-up version of the changes made to the specification and claims by the current amendment. The attached page is captioned "Version With Markings to Show Changes Made."

In view of the above, each of the presently pending claims in this application is believed to be in immediate condition for allowance. Accordingly, the Examiner is respectfully requested to withdraw the outstanding rejection of the claims and to pass this application to issue.

Dated: August 12, 2002

Respectfully submitted,

By

 Reg. No. 34,378  
Mark J. Thronson

Registration No.: 33,082

DICKSTEIN SHAPIRO MORIN &  
OSHINSKY LLP

2101 L Street NW

Washington, DC 20037-1526

(202) 785-9700

Attorneys for Applicant

**Version With Markings to Show Changes Made**

In the Written Description

Please amend the written description as follows:

Page 3, last paragraph through page 4, second full paragraph:

The first rotor core incorporating the permanent magnet is arranged in substantial V shape permanent magnet insertion hole and in such a way that a V shape concave portion is provided between poles in the vicinity of the outer surface on the first rotor core, so that the gap length of the magnetic path on the q-axis side is greater than that on the d-axis side.

On the other hand, the second rotor core as a reluctance torque rotor is provided with an almost true round peripheral shape, and is provided with a flux barrier without a permanent magnet placed in the permanent magnet insertion hole and without a concave portion formed between poles.

The arrangement described above ensures that the armature reaction magnetic flux cannot easily pass through the first rotor core with the permanent magnet embedded therein, because of the V shape concave portion provided between poles in the vicinity of the outer surface, whereas armature reaction magnetic flux can pass through the interpolar core of the second rotor core without a permanent magnet placed in the permanent magnet insertion hole and without a concave portion formed between poles.

Page 6, second full paragraph:

A further characteristic of the present invention is found in that the number of [permanent magnet insertion holes] the flux barrier on the second rotor core greater than that of the permanent magnet insertion holes provided on the first rotor core to ensure easy passage of armature reaction magnetic flux, thereby allowing reluctance torque to be increased.

Page 10, last paragraph:

The second rotor core 2 comprises a flux barrier [(hole)] 8 having identically the same shape as that of the permanent magnet insertion hole 3, namely, the convex V-shaped flux barrier [(hole)] 8 with respect to the shaft of rotor 10, as well as a rotor shaft hole 9 for being fitted to the shaft (not illustrated), and a [river] rivet hole 11 for securing the second rotor core.

Page 13, second full paragraph:

By [contract] contrast, when the arrangement of the second rotor core 2 shown in Fig. 4 is used, passage of the armature reaction magnetic flux through the interpolar core 13 of the second rotor core is easy.

Page 14, second full paragraph:



The permanent magnet insertion hole 3 of in the first rotor core 1 is made in identically the same form as the flux barrier [(hole)] 8 of the second rotor core 2. This has an effect of increasing the mass production efficiency of core sheets for the first and second rotor cores formed by lamination of the core sheets.

Page 14, fourth full paragraph:

In Fig. 5, the same components as those in Fig. 2 will be assigned with the same numerals to avoid redundant explanation. The difference from Fig. 2 is that the width of the flux barrier [(hole)] 8 of the second rotor core 2 is smaller.

Page 14, last paragraph:

In other words, the width of flux barrier [(hole)] 8 is reduced similarly to the flux barrier 81 so that the permanent magnet 4 will not enter the second rotor core 2 when the permanent magnet 4 is inserted in the axial direction of the first rotor core 1. Then the permanent magnet 4 is positioned. This has the effect of reducing the number of production processes -- another advantage in addition to the basic performance described in the first Embodiment.

Page 15, last paragraph:

In other words, the position of the flux barrier [(hole)] 8 is shifted toward an outer diameter direction so that the permanent magnet 4 will not enter the second rotor core 2 when the permanent magnet 4 is inserted in the axial direction of the first rotor core 1.

Then the permanent magnet 4 is positioned. This has the effect of reducing the number of production processes -- another advantage in addition to the basic performance described in the first embodiment.

Page 16, second full paragraph:

In the drawing, the same components as those in Fig. 2 will be assigned with the same numerals to avoid redundant explanation. The difference from Fig. 2 is that the flux barrier [(hole)] 8 of the second rotor core 2 is divided into two flux barriers [(hole)] 83 and 84 in order to ensure easy passage of armature reaction magnetic flux. This provides the same basic performance as that of the first embodiment, and will increase reluctance torque.

Page 17, second paragraph:

Correspondingly, the shape of the flux barrier [(hole)] 85 of the second rotor core 2 is also changed. This has the effect of providing the basic performance described in the first embodiment.

Page 17, fourth paragraph:

In the drawing, the same components as those in Fig. 2 will be assigned with the same numerals to avoid redundant explanation. The difference from Fig. 2 is that the permanent magnet insertion hole 32, permanent magnet 42 in the first rotor core 1 and

the flux barrier [(hole)] 86 of the second rotor core 2 are formed like a letter U (an arched form).

Page 18, second full paragraph:

In the drawing, the same components as those in Figs. 1 and 2 will be assigned with the same numerals to avoid redundant explanation. The difference of Fig. 10 from Figs. 1 and 2 is that balance weights 19 and 20 are on the first rotor core 1 and the second rotor core 2 respectively, and the flux barrier [(hole)] 8 is filled with the balance weight 20 of non-magnetic substance on the second rotor core 2 side.

Page 19, second full paragraph:

In the drawing, the same components as those in Fig. 2 will be assigned with the same numerals to avoid redundant explanation. The difference from Fig. 2 is that the flux barriers [(holes)] 86 and 87 of the second rotor core 2 are arranged to form a dual V-shape in order to ensure easy passage of armature reaction magnetic flux.

Page 20, second paragraph:

Correspondingly, the shape of flux barriers [(holes)] 88 and 89 of the second rotor core 2 is also changed. This will provide the same basic performance as that of the first embodiment.

Page 20, last paragraph:

Correspondingly, the flux barrier [(hole)] 8 of the second rotor core 2 is also changed into flux barriers [(holes)] 801 and 802 of dual U-shaped (arched) structure. This will provide the same basic performance as that of the first embodiment, and will increase reluctance torque in the second rotor core 2.

Page 25, second full paragraph:

By [contract] contrast, in the permanent magnet type rotating electrical machine 63 according to the present invention, a concave portion is provided on the interpolar core 5 of the first rotor core 1 where permanent magnet 4 is inserted to reduce the change in [reluctance] reactance on the rotor core 1 side.

In the Claims:

Please cancel claims 4, 6, and 7 without prejudice or disclaimer of the subject matter thereof.

Please amend the claims as follows:

1. (Amended) A permanent magnet [type] rotating electrical machine comprising:

a stator provided with concentrated winding armature wiring in multiple [slots] teeth on a stator core,

a first rotor core split into multiple parts in [the] an axial direction and containing permanent magnets built in multiple permanent magnet insertion holes having substantially V shapes, and

a second rotor core for producing reluctance torque,

[said permanent magnet type rotating electrical machine characterized in that] wherein said first rotor core is arranged so that [the] a gap length of [the] a magnetic path on the q-axis side is greater than that on the d-axis side.

2. (Amended) A permanent magnet [type] rotating electrical machine comprising[;]:

a stator provided with concentrated winding armature wiring in multiple [slots] teeth on a stator core,

a first rotor core split into multiple parts in [the] an axial direction and containing permanent magnets built in multiple permanent magnet insertion holes having substantially V shapes, and

a second rotor core for producing reluctance torque[;],

[said permanent type rotating electrical machine characterized in that] wherein

a concave portion is provided between poles in [the] a vicinity of [the] an outer surface on said first rotor core, and a flux barrier having almost the same form as that of said permanent magnet insertion hole is formed on said second rotor core in [the] a cross section in [the] a radial direction.

3. (Amended) A permanent magnet [type] rotating electrical machine comprising[;]:

a stator provided with concentrated winding armature wiring in multiple [slots] teeth on a stator core,

a first rotor core split into multiple parts in [the] an axial direction and containing permanent magnets built in multiple permanent magnet insertion holes having substantially V shapes, and

a second rotor core for producing reluctance torque[;],

[said permanent type rotating electrical machine characterized in that] wherein

a concave portion is provided between poles in [the] a vicinity of [the] an outer surface on said first rotor core, [and]

a flux barrier having almost the same form as that of said permanent magnet insertion hole, and

an almost true round peripheral shape [are] is formed on said second rotor core in [the] a cross section in [the] a radial direction.

5. (Amended) A permanent magnet [type] rotating electrical machine according to any one of Claims 1 to [4] 3 [characterized in the] wherein

[the] a width of said permanent magnet insertion hole on said first rotor core is [designed] greater than that of [said] a flux barrier [or said hole] provided on said second rotor core.

8. (Twice amended) A permanent magnet [type] rotating electrical machine according to any one of Claims [1 to 4, 6 and 7] 1-3 and 5 [characterized in that] wherein arrangement of said permanent magnet insertion hole provided on said first rotor core is different from that of [said] a flux barrier [or said hole] provided on said second rotor core.

9. (Twice amended) A permanent magnet [type] rotating electrical machine according to Claim 8 [characterized in that] wherein the number of said flux barriers [or holes] provided on said second rotor core is greater than that of said permanent magnet insertion holes provided on said first rotor core.

10. (Twice amended) A permanent magnet [type] rotating electrical machine according to Claim 8 [characterized in that] wherein said permanent magnet insertion holes provided on said first rotor core and [the] said flux barriers [or holes] provided on said second rotor core are formed in a straight line or [shaped] a shape like letter U or V.

11. (Twice amended) A permanent magnet [type] rotating electrical machine according to Claim 10 [characterized in that] wherein

said permanent magnet insertion holes provided on said first rotor core and [the] said flux barriers [or holes] provided on said second rotor core are formed with a shape like a letter [duplicate] U or V.

12. (Twice amended) A permanent magnet [type] rotating electrical machine according to Claim 11 [characterized in that] wherein

non-magnetic substances are inserted in [the] said flux barriers [or holes] provided on said second rotor core.

13. (Twice amended) A permanent magnet [type] rotating electrical machine according to Claim 12 [characterized in that] wherein

[said] the permanent magnet rotating electrical machine is driven by a 180-degree current-applied sinusoidal wave inverter without magnetic pole position sensor.

14. (Twice amended) A compressor arranged to be driven by a permanent magnet [type] rotating electrical machine according to Claim 13.